



Current and future assisted reproductive technologies for mammalian farm animals

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Year: 2014
Journal: Advances in Experimental Medicine and Biology. 752: 22-Jan

Abstract:

Reproduction in domestic animals is under control by man and the technologies developed to facilitate that control have a major impact on the efficiency of food production. Reproduction is an energy-intensive process. In beef cattle, for example, over 50 % of the total feed consumption required to produce a unit of meat protein is consumed by the dam of the meat animal (Anim Prod 27:367-379, 1978). Sows are responsible for about 20 % of the total feed needed to produce animals for slaughter (Adv Pork Prod 19:223-237, 2008). Accordingly, energy input to produce food from animal sources is reduced by increasing number of offspring per unit time a breeding female is in the herd. Using beef cattle as an example again, life-cycle efficiency for production of weaned calves is positively related to early age at puberty and short calving intervals (J Anim Sci 57:852-866, 1983). Reproductive technologies also dictate the strategies that can be used to select animals genetically for traits that improve production. Of critical importance has been artificial insemination (AI) (Anim Reprod Sci 62:143-172, 2000; Stud Hist Philos Biol Biomed Sci 38:411-441, 2007; Reprod Domest Anim 43:379-385, 2008; J Dairy Sci 92:5814-5833, 2009) and, as will be outlined in this chapter, emerging technologies offer additional opportunities for improvements in genetic selection. Given the central role of reproduction as a determinant of production efficiency and in genetic selection, improvements in reproductive technologies will be crucial to meeting the challenges created by the anticipated increases in world population (from seven billion people in 2011 to an anticipated nine billion by 2050; World population prospects: the 2010 revision, highlights and advance tables. Working Paper No. ESA/P/WP.220, New York) and by difficulties in livestock production wrought by climate change (SAT eJournal 4:1-23, 2007). The purpose of this chapter will be to highlight current and emerging reproductive technologies that have the potential to improve efficiency of livestock production. The focus will be on technologies that manipulate male and female gametes as well as the stem cells from which they are derived and the preimplantation embryo. While technology is crucial to other interventions in the reproductive process like control of seasonal breeding, hormonal regulation of ovulation, estrous cyclicity and pregnancy establishment, feeding to optimize reproduction, minimizing environmental stress, and selection of genes controlling reproduction, these will not be considered here. Rather the reader is directed to other chapters in this volume as well as some reviews on other aspects of artificial manipulation of reproduction (Reprod Fertil Dev 24:258-266, 2011; Reprod Domest Anim 43:40-47, 2008; Reprod Domest Anim 43:122-128, 2008; Soc Reprod Fertil Suppl 66:87-102, 2009; Comprehensive biotechnology, Amsterdam, pp 477-485; Dairy production medicine, Chichester, pp 153-163; Theriogenology 76:1619-1631, 2011; Theriogenology 76:1568-1582, 2011; Theriogenology 77:1-11, 2012). Given the large number of mammalian species used for production of products useful for man and the diversity in their biology and management, the review will not be comprehensive but instead will use results from species that are most illustrative of the opportunities generated by assisted reproductive technologies.

Source: http://dx.doi.org/10.1007/978-1-4614-8887-3_1

Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Food/Water Security

Food/Water Security: Agricultural Productivity

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Global or Unspecified

Health Impact:

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Resource Type:

format or standard characteristic of resource

Review

Timescale:

time period studied

Time Scale Unspecified